Innovative Rotary Crossflow System for Volume Reduction of Mixed Hazardous and Rad Waste

Developer: SpinTek Systems, Inc.
Contract Number: DE-AC21-96MC33136
Crosscutting Area: ESP

Subsurface Contaminants FOCUS AREA

Problem:

The Department of Energy (DOE) has many nuclear weapons-related facilities requiring the separation of radioactive materials from a liquid waste or process stream to reduce the quantity of radioactive material for disposal. In addition to waste minimization, DOE is also interested in concentrating organic materials and in fractionating closely sized particles.

Solution:

Develop a membrane separation technology that is able to 1) efficiently reject radioactive and other contaminants, 2) produce a permeate that is relatively free of radionuclides and other contaminants, and 3) reach large concentration factors while maintaining a high permeate flux.

Benefits:

This technology is applicable to many DOE sites. Following successful demonstration of the technology, SpinTek systems will be rapidly deployed on a wide range of waste and process streams throughout the DOE Complex.

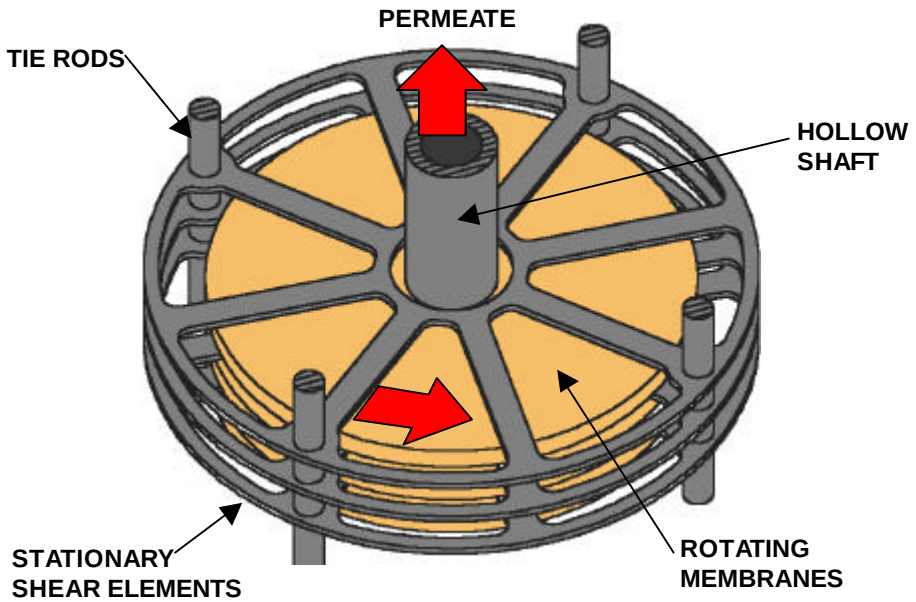
Typical applications for which the SpinTek system is recommended include:

- Processes requiring fine particle filtration without generating a secondary waste
- Operations where it is undesirable to use thermal processes
- Applications where materials to be removed include colloidal, metal hydroxides, or other suspended solids
- Fractionation applications where it is desirable to separate components with differing particle sizes
- Operations where conventional membrane systems cannot operate without fouling
- Situations where stainless steel, titanium, or Teflon materials are required because of waste chemistry

Technology:

The SpinTek ST-II High Shear Rotary Membrane Filtration System (Figure 1) uses a series of flat, round membrane disks (only one disk is shown) set on a hollow rotating shaft inside a cylindrical housing. The influent enters the membrane

Figure 1 - SpinTek ST-II High Shear Rotary Membrane Filtration System



chamber under pressure and is distributed across the membrane surface. Permeate is forced through the membrane and is collected in the hollow shaft and is discharged. The concentrate exits at the edge of the membrane packs.

In conventional membrane systems, the buildup of rejected material at the membrane surface ("concentration polarization") is reduced by recycling a large portion (»98%) of the concentrate back to the membrane unit so that large liquid velocities are produced near the membrane surface. The large velocities increase turbulence which reduces the thickness of the solute boundary layer.

In the SpinTek ST-II High Shear Rotary Membrane Filtration System, the rotation of the membrane disks produces the turbulence required to effectively eliminate the solute boundary layer. In addition to the rotational action, turbulence promoters ("wagon wheels") are located on each side of the membrane to prevent rotational flow (vortex formation) from occurring.

Maximum liquid velocities of about 15 ft/s are possible using conventional membrane systems, while the SpinTek ST-II system liquid velocities are typically 60 ft/s. As the waste is concentrated with treatment time, a conventional membrane system is not able to maintain the high cross-flow velocities because of the difficulty in pumping viscous material at high flow rates. The SpinTek ST-II system does not rely on pumping to produce the required liquid velocities. Therefore, extremely concentrated wastes can be treated.

Contacts:

SpinTek Membrane Systems produces a variety of innovative technologies for the treatment of radioactive, hazardous, and industrial wastes. For information regarding this project, the contractor contact is:

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